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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

September 1968 United States Employment Service Technical Report S-422

S-422

Development of USES Aptitude Test Battery for Radiation Monitor

(profess. & kin.) 199.187

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION

Technical Report on Development of USES Aptitude Test Battery

For . . . .

Radiation Monitor (profess. & kin.) 199.187

S-422

(Developed in Cooperation with the
Connecticut State Employment Service)

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September 1968

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

Charles E. Odell, Director
U.S. Employment Service

GATB Study #2713

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Radiation Monitor (profess. & kin.) 199.187-010

S-422

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Radiation Monitor 199.187-010. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, B-1002 Scores
G - General Learning Ability	105
N - Numerical Ability	95
Q - Clerical Ability	100

RESEARCH SUMMARY

Sample:

55 Male Radiation Monitors employed at the following plants:

Union Carbide, Nuclear Div., Oak Ridge, Tenn.
Brookhaven National Laboratories, Yaphank, N. Y.
Ingalls Shipbuilding Corp., Pascagoula, Miss.
Electric Boat Div., General Dynamics, Groton, Conn.
Lovelace Foundation Laboratories, Albuquerque, N. Mexico
Los Alamos Scientific Laboratories, Los Alamos, N. Mexico
General Atomic Div., General Dynamics, San Diego, Calif.

Criterion

Supervisory ratings

Design

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity: Phi Coefficient = .27 ($P/2 < .025$)

Effectiveness of Norms: 78% of the non-test-selected workers used for this study were good workers; if the workers had been test selected with the above norms, 87% would have been good workers. 22% of the non-test-selected workers used for this study were poor workers, if the workers had been test selected with the above norms 13% would have been poor workers. The effectiveness of the norms is shown graphically in Table I:

TABLE I

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	78%	87%
Poor Workers	22%	13%

SAMPLE DESCRIPTION

Size: N = 55

Occupational Status: Employed Workers

Work Setting: Workers are employed throughout the nation at various plants utilizing atomic energy.

Selection Requirements:

Education: High School to 2 years of college preferred.

Previous Experience: On the job training was given part of the sample, others required experience. The greater portion of the sample from Groton, Conn. had served as crew members on atomic submarines.

Tests: The Electric Boat, Groton, Conn. is the only one using the following tests. Wonderlic Personnel Form B and Saader General Mathematics Tests.

Other: All had personal interviews and physical examinations.

Principal Activities: The job duties for each worker are comparable to those shown on the job description in the appendix.

Minimum Experience: All workers in the sample had a minimum of 9 months total on the job experience.

TABLE II

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

	Mean	SD	Range	r
Age (years)	35.3	9.2	21-59	-.078
Education (years	13.7	1.6	11-16	.242
Experience (mos.)	77.9	56.0	9-185	-.257

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B (NCS) were administered during 1965 and 1967.

CRITERION

The criterion data consisted of two supervisory ratings of job proficiency spaced at least two weeks apart shortly after the test data was collected.

Rating Scale: USES Form SP-21 "Descriptive Rating Scale". (See appendix)

Reliability: Correlation between the first and second rating was .791 significant at the .01 level.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	44-89
Mean:	68.6
Standard Dev.	9.1

Criterion Dichotomy: The criterion distribution was dichotomized into low and high groups by placing 22% of the sample in the low group to correspond with the percentage of workers considered marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers". The criterion critical score is 63.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes N and Q which did not have high correlations with the criterion were considered for inclusion in the norms because the qualitative analysis indicated that both were important for the job duties and the sample had a relatively high mean score and a low standard deviation on these aptitudes.

TABLE III

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
G - Intelligence	Essential in collecting and interpreting radiation level data, and in making decisions as to the actions to be taken.
V - Verbal Ability	Ability to read and interpret safety rules and regulations. Acts as instructor of personnel in rules, safety methods, and use of equipment.
N - Numerical Ability	Calculate allowable working times for personnel in high radiation areas, individual exposure, and radiation levels.
Q - Clerical Ability	To record instrument readings, keep statistical records

TABLE IV

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Aptitudes	Mean	SD	Range	r
G-General Learning Ability	114.8	14.7	78-145	.308*
V-Verbal Aptitude	108.1	15.0	78-143	.296
N-Numerical Aptitude	113.9	13.5	86-143	.189
S-Spatial Aptitude	112.6	17.8	68-143	.261
P-Form Perception	113.5	20.0	70-155	.041
Q-Clerical Perception	115.5	14.0	80-148	.254
K-Motor Coordination	108.6	17.8	58-148	.028
F-Finger Dexterity	102.7	20.6	45-144	-.064
M-Manual Dexterity	108.1	21.8	55-156	.128

*Significant at the .05 level

TABLE V

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Qualitative Analysis of Aptitudes Required	X	X	X			X			
Aptitudes with Relatively High Means	X		X		X	X			
Aptitudes with Relatively Low Standard Deviations	X	X	X			X			
Significant Correlation with Criterion	X	X							
Aptitudes to be Considered for Trial Norms	G	V	N			Q			

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of aptitudes G,V,N, and Q at trial cutting scores were able to differentiate between the 78% of the sample that were considered good workers and the 22% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores slightly higher than one standard deviation below the mean will eliminate about one-third of the sample; for four-aptitude trial norms, cutting scores slightly lower than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of G-105, N-95, and Q-100 provided the highest degree of differentiation for the occupation of Radiation Monitor (profess. & kin.) 199.187-010. The validity of these norms is shown in Table VI and is indicated by a Phi Cofficient of .27 (statistically significant at the .025 level.)

TABLE VI

Concurrent Validity of Test Norms, G-105, N-95, and Q-100

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	10	33	43
Poor Workers	7	5	12
Total	17	38	55

Phi Coefficient (Ø) = .27 Chi Square (X^2) = 3.9
Significance Level = P/2 < .025

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-9 which is shown in Section II of the Guide to the Use of the General Aptitude Test Battery. A Phi Coefficient of .26 is obtained with the OAP-9 norms of G-95, N-90, and Q-95.

SP-21
Rev. 2/61

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(FOR Aptitude Test Development Studies)

Score_____

RATING SCALE FOR_____
D.O.T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print)_____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title:_____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

- ☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.
- ☐ 2. Capable of low work output. Can perform at a slow pace.
- ☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.
- ☐ 4. Capable of high work output. Can perform at a fast pace.
- ☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

- ☐ 1. Performance is inferior and almost never meets minimum quality standards.
- ☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.
- ☐ 3. Performance is acceptable but usually not superior in quality.
- ☐ 4. Performance is usually superior in quality.
- ☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

- ☐ 1. Makes very many mistakes. Work needs constant checking.
- ☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.
- ☐ 3. Makes mistakes occasionally. Work needs only normal checking.
- ☐ 4. Makes few mistakes. Work seldom needs checking.
- ☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by".

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would he be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

FACT SHEET

Job Title: Radiation Monitor (profess. & kin.) 199.187-010

Work Performed: Responsible for the safety of plant personnel by locating and identifying existing and potential radiation sources and radiation contamination in environment, specific work sites and personnel through daily monitoring with a variety of specialized detection equipment. Determines presence and extent of radioactivity in environment by collecting samples, such as air and water, using instruments such as an Alpha-Beta-Gamma Counter. Monitors radiation areas, such as nuclear reactor components, to determine radiation intensity through the use of Survey Meters. Also takes smear tests with filter paper and uses counter to determine data. Monitors personnel to determine extent of radiation exposure by daily issuing, collecting, processing, and evaluation of personnel monitoring equipment, such as Film Badge and Dosimeter. Determines allowable working times of personnel in high radiation areas to prevent over-exposure. Calculates individual exposure to radiation and maintains a cumulative record on each individual. Determines whether necessary, on the basis of his findings, to take immediate preventive or corrective action to assure radiological safety of personnel, and follows standard procedures involving such measures as area evacuation, shutdown of reactors, posting of warning barriers and access restriction, or reclaiming contaminated equipment. Determines decontamination procedures and decontaminates, washing with various types of chemical solvents and detergents; authorizes release of decontaminated materials. Instructs personnel concerning governmental and plant safety rules and requirements and methods of protection. Determines type of an issues needed of protective clothing and equipment for workers in various areas and instructs workers in their use. Determines need for and type of continuous fixed and portable monitoring detection instruments and alarms in various plant areas. Conducts periodic surveillance and calibration of radiation detection devices to ensure proper operation. Keeps statistical records of findings and activities. In some instances may report to Health Physics Supervisor when radiation levels approach the maximum allowable or when necessary to initiate corrective action: May periodically make radio-urinalyses of personnel. May instruct other personnel in decontamination methods or use of detecting equipment. May perform routine repairs on detection equipment.

Effectiveness of Norms: Only 78% of the test-selected workers used for this study were good workers; if the workers had been test-selected with the S-422 norms, 87% would have been good workers. 22% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-422 norms, only 13% would have been poor workers.

Applicability of S-422 Norms: The aptitude test battery is applicable to jobs which contain a majority of the job duties described above.

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